NOV - 8 2000

510(K) SUMMARY: CARESIDE™ *CHOLINESTERASE* SAFETY AND EFFECTIVENESS

K002792

I. Applicant Information

A.	Applicant Name	**CARESIDE, Inc.**
B.	Applicant/Manufacturer Address	6100 Bristol Parkway Culver City, CA 90230
C.	Telephone Number	310-338-6767
D.	Contact Person	Kenneth B. Asarch, Pharm.D., Ph.D.
E.	FAX Number	310 670-6986
F.	e-Mail Address	kasarch@careside.com
G.	Date 510(k) Summary prepared	October 25, 2000

II. Device Information

A.	Device Name (Trade)	**CARESIDE™ *Cholinesterase***
B.	Device Name (Classification)	**Cholinesterase** test system
C.	Device Classification	Clinical chemistry and toxicology panel **Cholinesterase** test system Regulation Number: 21 CFR 862.3240 Regulatory Class: II Classification Number: 91DIH
D.	Special controls and performance standards	None applicable

III. Substantial Equivalence Claim

A. General equivalency claim

The ability to measure analytes in dry film and other formats is widely recognized and has gained widespread acceptance for use in cholinesterase activity tests.

Cholinesterase *in vitro* diagnostic products, in both dry film and other formats, are already on the U.S. market.

B. Specific equivalency claim

This CARESIDE™ *Cholinesterase* test is substantially equivalent in intended use and performance to the Vitros CHE DT slides for the quantitative measurement of cholinesterase activity on the DTSC II system (currently marketed by Johnson and Johnson, Inc.). Both are based on the principle of dry film and are read by reflectance photometry; however, the Vitros CHE DT Slide method is based upon the use of the substrate butyrylthiocholine.

Name of Predicate Device:	Vitros DT Slides (currently marketed by Johnson and Johnson) for the **DTSC II system.**
Predicate Device 510K number:	**K913198/A**
Product Code:	91DIH

IV. Device Description

CARESIDE™ *Cholinesterase* cartridges are used with the CARESIDE *Analyzer* to measure cholinesterase activity in applied whole blood specimens, serum, or plasma. The CARESIDE™ *Cholinesterase* cartridge, a single use disposable *in vitro* diagnostic test cartridge, delivers a measured volume of plasma or serum (as applicable) to a dry film to initiate the measurement of cholinesterase activity. The patented film cartridge contains everything necessary to measure cholinesterase activity.

A. Explanation of Device Function

Each CARESIDE™ *Cholinesterase* cartridge consists of a cholinesterase-specific multi-layer film mounted in a plastic base with a hinged lid. The user introduces the specimen into the cartridge Sample Well, closes the lid and inserts the cartridge into the CARESIDE *Analyzer*.

Once loaded, the CARESIDE *Analyzer* scans the cartridge barcode and spins the cartridge to move the sample from the Sample Well into the cartridge channels and chambers. Sample (8.5 microliters) remains in the metering passage. Any excess sample flows into an overflow well.

The sample is automatically dispensed onto the multi-layer film. The spreading layer distributes the specimen uniformly. Cholinesterase (CHE) in the sample hydrolyzes para-hydroxy benzoyl choline to form para-hydroxy benzoic acid and choline. The choline is oxidized by choline oxidase (CHO) to form hydrogen peroxide and betaine. The hydrogen peroxide reacts with a leuco-dye in a reaction catalyzed by peroxidase (POD) to form an imidazole dye. The rate of change of the color intensity of the greenish-blue dye, as measured by the amount of reflected light at 655 nanometers, directly relates to the cholinesterase activity of the specimen.

Test Reaction Sequence:

$$\text{p-(OH) benzoyl choline} + H_2O \xrightarrow{\text{CHE}} \text{p-(OH) benzoic acid} + \text{Choline}$$

$$\text{Choline} + H_2O + 2\,O_2 \xrightarrow{\text{CHO}} \text{Betaine} + 2\,H_2O_2$$

$$H_2O_2 + \text{Leuco-dye} \xrightarrow{\text{POD}} \text{Imidazole dye}$$

As the cartridges spin, a photodiode measures the reflected light emitted by a wavelength-specific light emitting diode (LED) over a fixed time period. The instrument uses the rate of change of reflectance measurements and the lot-specific standard curve to calculate cholinesterase activity.

B. Test Summary

Cholinesterase is a term for a group of enzymes that hydrolyze choline esters at a faster rate than other esters. Cholinesterases occur in two groups: true acetylcholinesterase (also known as red cell cholinesterase, or choline esterase-I) and pseudocholinesterase (also known as serum cholinesterase, benzoyl cholinesterase, or choline esterase-II). The CARESIDE *Cholinesterase* measures pseudocholinesterase. True acetylcholinesterase (found in red cells as well as, lung, spleen, nerve

endings, and the gray matter of the brain) is not measured for clinical use. Acetylcholinesterase measured in non-separated whole blood represents a composite of pseudo- and true-cholinesterase. The physiological function of pseudocholinesterase is unknown. True acetylcholinesterase is responsible for breaking down acetylcholine after it is released at nerve endings during transmission of the neural impulse. The CARESIDE *Cholinesterase* provides a plasma or serum result; it does not provide a whole blood result even when a whole blood sample is applied to the cartridge.

Pseudocholinesterase (henceforth referred to as cholinesterase) is generated and released from the liver. The measurement of cholinesterase activity is used in the determination of the synthetic capacity of the liver. In the absence of genetic causes or known cholinesterase inhibitors, a decrease in cholinesterase activity in serum or plasma may reflect impaired synthesis of the enzyme by the liver, acute infection, pulmonary embolus, muscular dystrophy, chronic renal disease, pregnancy, or post-operative or post-myocardial infarction status. Acute hepatitis and chronic hepatitis of long duration result in 30-50% cholinesterase decreases and advanced cirrhosis and carcinoma with hepatic metastases result in 50-70% cholinesterase decreases.

Pseudocholinesterase measurement is useful in the diagnosis and management of organophosphorus insecticide poisoning which causes the inhibition of cholinesterase activity in serum or plasma. Cholinesterase measurements are also used in the identification of patients with inherited cholinesterase variants. Such individuals can experience prolonged apnea when receiving the anesthetic succinylcholine.

V. Intended Use

A. Intended Use

The CARESIDE™ *Cholinesterase* cartridge is intended for *in vitro* diagnostic use in conjunction with the CARESIDE *Analyzer* to quantitatively measure cholinesterase activity in an applied whole blood, plasma, or serum sample.

B. Indications for Use

This product is indicated for use in the diagnosis and treatment of patients with insecticide poisoning and liver disease.

VI. Technological Characteristics

A. Similarities

	CARESIDE™ *Cholinesterase*	Vitros CHE DT Slides
Intended Use	Primarily to aid in the diagnosis and treatment of patients with insecticide poisoning and liver disease.	Same
Indications	For *in vitro* diagnostic use.	For *in vitro* diagnostic use.
Measurement	Quantitative	Same
Method Principle	Dry film	Dry film
Specimen dilution	Not required	Same
Materials	p-hydroxy benzoyl choline	Butyrylthiocholine
Detector	Reflectance (655 nm)	Reflectance (400 nm)
Test time	Less than 9 minutes for total test cycle.	30 minutes slide warm-up (off-line) plus 5 minutes test time at 37°C.
Sample Type	Whole blood (WB applied, plasma result), serum or plasma	Serum or plasma
Specimen volume	8.5 µl test volume 90±10µl applied volume	10 µl
Calibration	Calibration information bar-coded on each cartridge. Calibration information may change with each lot.	Run DTSC II calibrators whenever a new slide lot is used or when necessary.
Quality Control	2 levels	Same
Reporting Units	U/L	Same

B. Differences

	CARESIDE™ *Cholinesterase*	Vitros CHE DT Slides
Specimen Processing	Not required	Required
Accurate pipetting	Not required	Required
Disposable pre-warming	Not required	Required

C. Comparative Performance Characteristics

	CARESIDE™ *Cholinesterase*	Vitros CHE DT Slides
Detection limit (plasma)	500 U/L	200 U/L
Reportable range (plasma)	500 to 13000 U/L	200 to 12500 U/L
Accuracy (plasma)	Mean recovery 101%	Not provided
Precision (serum)	Total CV, 3.6% @ 4786 U/L	Total CV, 1.8% @ 5080 U/L
Method comparison (plasma)	CARESIDE™ = 1.08 (Vitros CHE DT) – 87 U/L, r = 0.99	
Linearity (plasma)	Linearity yielded slope and correlation coefficient within acceptable limits.	Not provided
Sample type comparison	WB=1.03 PL – 106U/L r = 0.96 Serum=1.09 PL + 20U/L r = 0.97	Not provided
Interference	No significant interference (±10%) was observed at the tested interferent concentration, except where specified: Ascorbic Acid,.....20 mg/dL Bilirubin .....20 mg/dL Hemoglobin.....50 mg/dL Ibuprofen.....4 mg/dL (+41% at 20mg/dL) L-Dopa.....10 µg/mL (-47% at 50 ug/ml) Phenazopyridine .....80 µg/dL Procainamide .....4 mg/dL Protein .....10 g/dL Triglycerides .....2000 mg/dL	Interferent Characterized Ibuprofen L-Dopa Low pH (6.8) Phenazopyridine Procainamide (see package insert for details)

D. Conclusion

The data provided demonstrate that the CARESIDE™ *Cholinesterase* product is as safe, effective, and performs as well as or better than the legally marketed predicate device

DEPARTMENT OF HEALTH & HUMAN SERVICES

Food and Drug Administration
2098 Gaither Road
Rockville MD 20850

NOV - 8 2000

Kenneth B. Asarch, Ph.D.
VP Quality Systems and Regulatory Affairs
Careside, Inc.
6100 Bristol Parkway
Culver City, California 90230

Re: K002792
Trade Name: CARESIDE™ Cholinesterase
Regulatory Class: I reserved
Product Code: DIH
Dated: October 25, 2000
Received: October 27, 2000

Dear Dr. Asarch:

We have reviewed your Section 510(k) notification of intent to market the device referenced above and we have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration.

If your device is classified (see above) into either class II (Special Controls) or class III (Premarket Approval), it may be subject to such additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 895. A substantially equivalent determination assumes compliance with the Current Good Manufacturing Practice requirements, as set forth in the Quality System Regulation (QS) for Medical Devices: General regulation (21 CFR Part 820) and that, through periodic QS inspections, the Food and Drug Administration (FDA) will verify such assumptions. Failure to comply with the GMP regulation may result in regulatory action. In addition, FDA may publish further announcements concerning your device in the Federal Register. Please note: this response to your premarket notification submission does not affect any obligation you might have under sections 531 through 542 of the Act for devices under the Electronic Product Radiation Control provisions, or other Federal laws or regulations.

This letter will allow you to begin marketing your device as described in your 510(k) premarket notification. The FDA finding of substantial equivalence of your device to a legally marketed predicate device results in a classification for your device and thus, permits your device to proceed to the market.

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801 and additionally 809.10 for in vitro diagnostic devices), please contact the Office of Compliance at (301) 594-4588. Additionally, for questions on the promotion and advertising of your device, please contact the Office of Compliance at (301) 594-4639. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21CFR 807.97). Other general information on your responsibilities under the Act may be obtained from the Division of Small Manufacturers Assistance at its toll-free number (800) 638-2041 or (301) 443-6597 or at its internet address "http://www.fda.gov/cdrh/dsma/dsmamain.html".

Sincerely yours,

Steven Gutman

Steven I. Gutman, M.D., M.B.A.
Director
Division of Clinical Laboratory Devices
Office of Device Evaluation
Center for Devices and Radiological Health

Enclosure

VII. INDICATIONS FOR USE

510(k) Number: K002792

Device Name: CARESIDE™ *Cholinesterase*

1. Indications for use: For *in vitro* diagnostic use with the CARESIDE *Analyzer*® to measure cholinesterase activity from applied whole blood, plasma or serum specimens to aid in the diagnosis and treatment of patients with insecticide poisoning and liver disease.

Jean Cooper
(Division Sign-Off)
Division of Clinical Laboratory Devices
510(k) Number K002792

(PLEASE DO NOT WRITE BELOW THIS LINE-CONTINUE ON ANOTHER PAGE IF NEEDED)

Concurrence of CDRH, Office of Device Evaluation (ODE)

Prescription Use ✓
(Per 21 CFR 801.109)

OR

Over-The-Counter Use ___
(Optional Format 1-2-96)